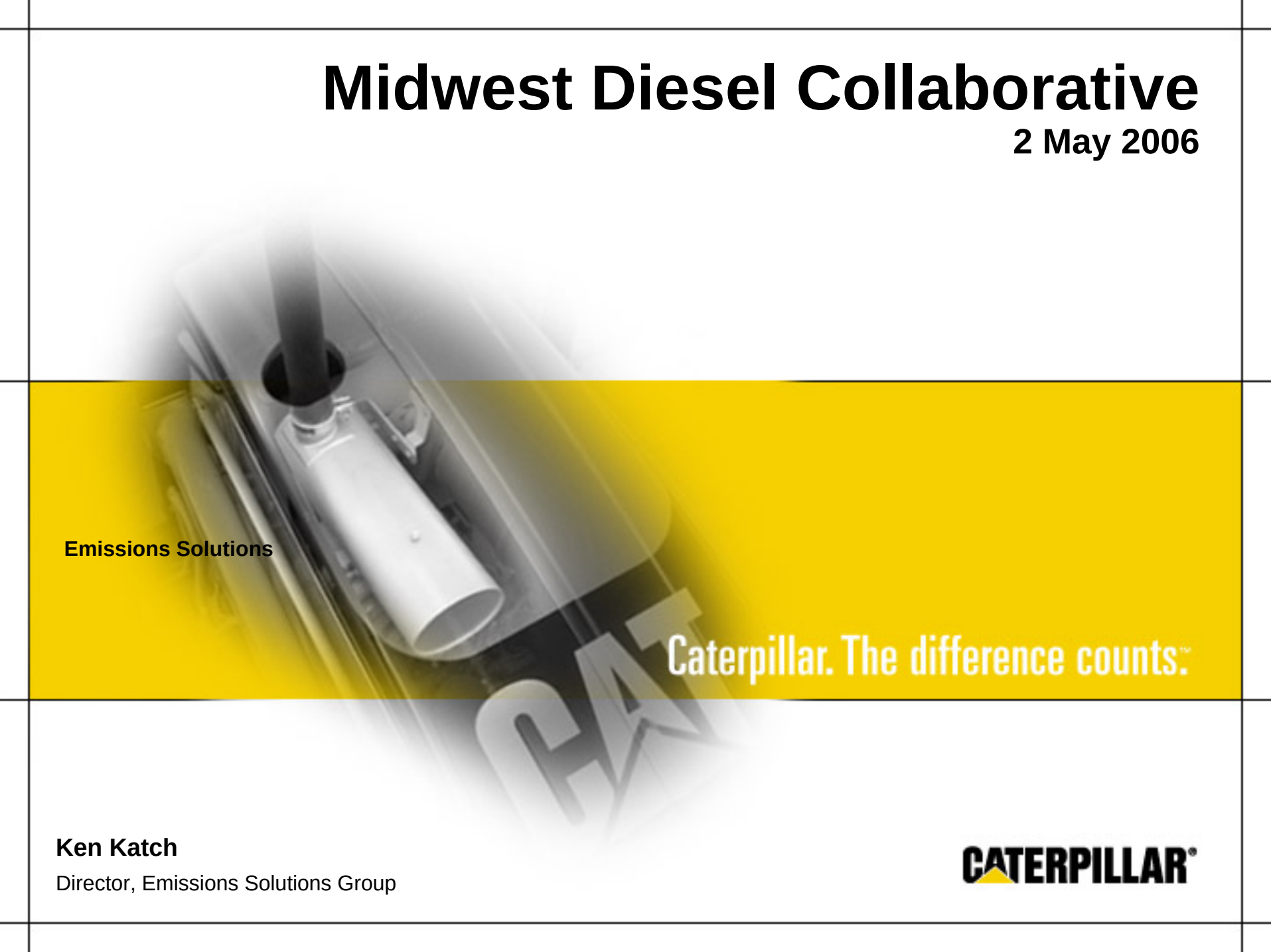
Midwest Diesel Collaborative

2 May 2006



Emissions Solutions

Caterpillar. The difference counts.™

Ken Katch

Director, Emissions Solutions Group

CATERPILLAR®

Diesel Technology

- Diesel is the workhorse of the economy
- Efficient
- Durable
- Clean

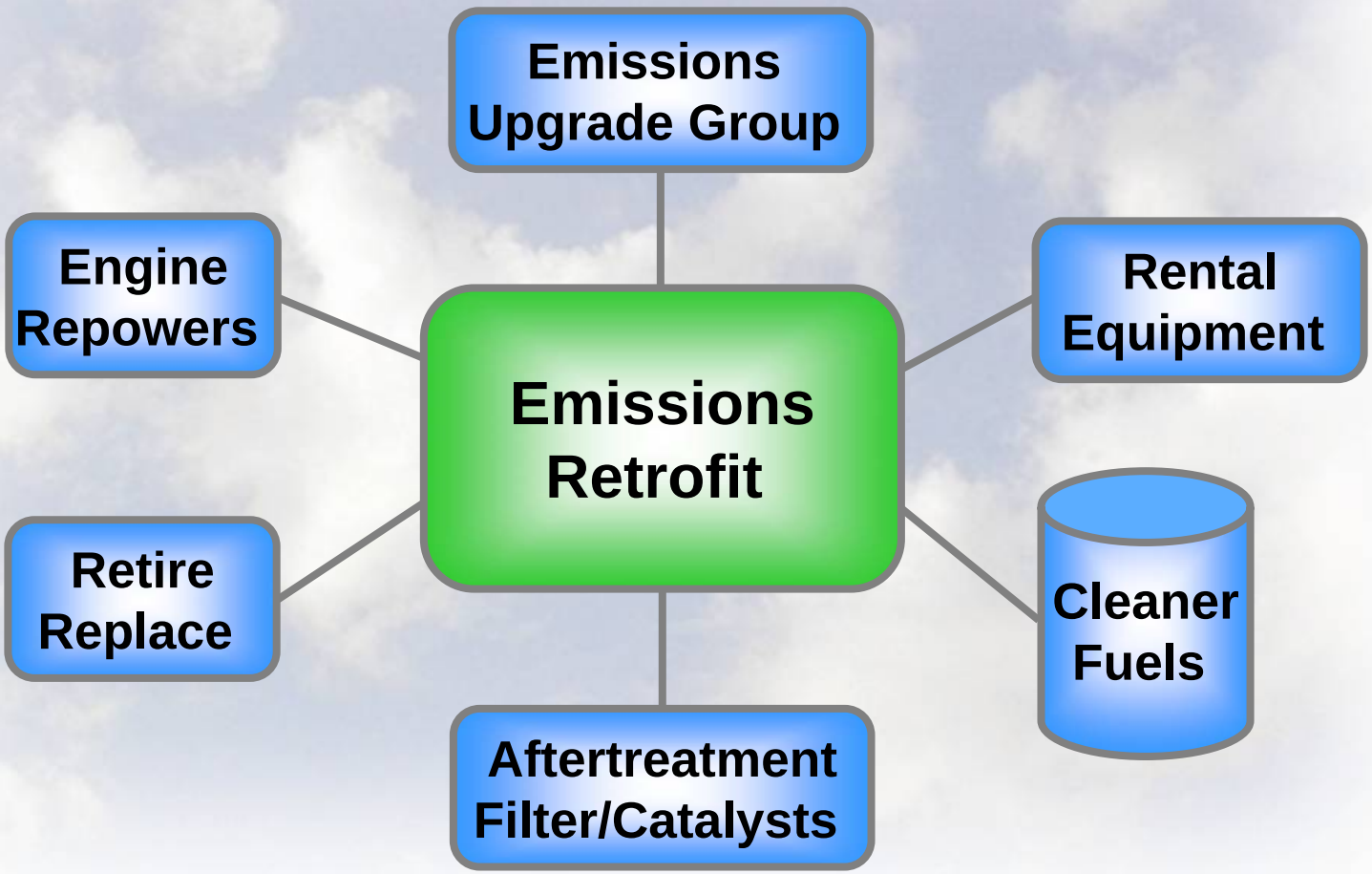
Technology Advances

- **Emissions Reduction through**
  - **Advanced Combustion Management**
  - **Application of Aftertreatment**
- **Maintaining the Customer Requirements**
  - **Fuel Economy**
  - **Reliability**
  - **Durability**

What About Legacy Engines?

- Diesel Advantage of Long Life
- Important Capital Asset for Owners

Solutions Overview



Emissions Retrofit Engine Repowers

Reducing emissions by replacing pre-Tier 1 engines in vehicles with regulated engines.

- Emission Repowers Started in 1999
- Primary NOx solution for Retrofit

Repower Considerations

- **Installation**
  - Engine and support systems must fit
- **Performance**
  - Specifications must match to maintain the drive train reliability and overall performance
- **Operation**
  - No modification can adversely affect the basic machine operation

End-of-Life Product Recovery is Key to Remanufacturing

- 2 million cores returned to Cat each year
- Over 100 million pounds remanufactured or recycled per year

The Remanufacturing Business Model

Promotes End-of-Life Product Recovery ...

1. **Remanufacturing requires a "one-for-one exchange"**
2. **Core deposits establish a consumer incentive to return cores**
3. **Remanufactured products encourage responsible end-of-life practices**

"One-for-One Exchange" = End-of-Life Recovery

Emissions Retrofit Upgrade Groups

An innovative use of previously certified technology!

- Available for select off-road applications
- Upgrade at overhaul from unregulated to Tier 1 levels
- Cost effective solutions
- Same Caterpillar reliability and serviceability

Oxidation Catalyst Technology

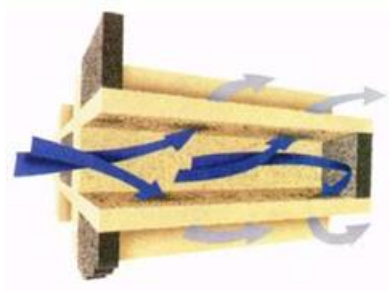
Diesel oxidation catalysts promote chemical oxidation of CO and HC as well as the soluble oil fraction (SOF) of diesel particulates.

- Up to 20% PM reduction
- Up to 90% reduction of CO, HC
- No significant NOx reduction
- Proven technology
- Easy maintenance
- ULSD not required

Diesel Particulate Filters

Diesel particulate filters are devices that physically capture diesel particulates (soot) to prevent their release to the atmosphere.

- 85% to 95% PM reduction
- Thermal soot regeneration
  - Passive regeneration
    - Majority of field experience
    - Application dependant
    - Minimum exhaust temp profile
  - Active regeneration
    - Emerging technologies
    - Performance not dependent on application and duty cycle
- Regular ash cleaning intervals
- ULSD fuel required < 15 ppm sulfur



Example Fleet Emissions Solution
After-treatment Solutions & Repower/Upgrade & Replace

Emissions Upgrade Group (Tier 1)	14
Tier 1 Repower	12
Tier 2 Repower	21
Tier 3 Repower (some Tier 1 to 3)	20
CCM	80
DPF	8
Machine Replacement	18

Fleet Average PM

HP	Org. Ave.	New Ave.	2010
26-174	0.356	0.291	0.300
175-750	0.368	0.142	0.150

School Bus Donation

- This project was done to support the EPA Clean School Bus USA initiative
- In 2004, Cat Dealer Altorfer installed oxidation catalysts on 93 buses for District 150 in Peoria, Illinois

Port of Cleveland Donation

- The purpose of the project is to promote/demonstrate what can be done with the Diesel Emissions Reduction Act grants
- Cat Dealer Ohio Power is retrofitting 26 pieces of cargo handling equipment with oxidation catalysts
    - 20 are complete; expect to be finished by the end of April 2006
    - Muffler replacements; take about 2-3 hours each
    - 8 different machine configurations consisting of small and large fork lifts and boom cranes
    - The engines are from various manufacturers with model years ranging from 1977 – 2003

Port of Cleveland Donation

Diesel Technology Summary

- Achieved significant gains in clean diesel technology
- 2007 is the next major step forward
- ULSD is critical to 2007 success
- Retrofit of the legacy diesel fleet is needed
- Voluntary programs with incentives are key